knight-kit®

KNIGHT-KIT KG-679
SIGNAL INJECTOR/TRACER

CONSTRUCTION HINTS

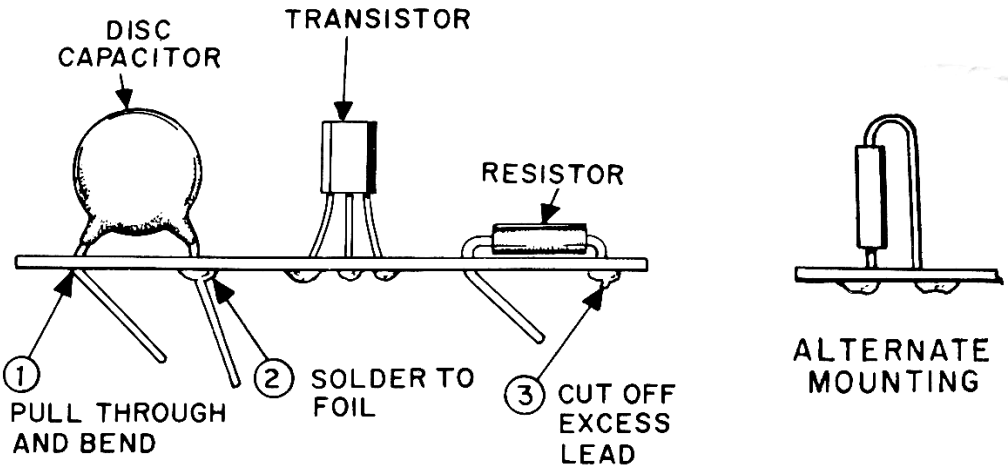
You are going to build a very useful piece of test equipment. The Signal Injector/Tracer produces an audio and radio frequency signal which can be used to check radio and audio circuits. It also can trace through a circuit for the presence of a signal (either audio or radio frequency).

Carefully follow the instructions and illustrations provided for you. You will need the following tools: a soldering iron with a small, pencil-type tip and a wattage rating of 15 to 30 watts; a pair of wire cutters; a pair of long-nose pliers; two screwdrivers—a regular one, and a Phillips-head type.

All of the parts are identified in the illustrations. Resistors are supplied mounted on a card which calls out the symbol and value.

The most important part of construction is soldering. Carefully study the soldering instructions given on the facing page. Here are a few additional hints:

1. When you mount parts on the printed circuit board, mount them as shown. Mount resistors as shown in the "Alternate Mounting" position. For capacitors, mount them down against the board. For transistors, mount them 3/8" above the board as shown.



2. Be sure each solder connection has a shiny, metallic finish when it is completed. If it does not look right, reheat and add a little solder if necessary.

3. After a wire or lead is soldered to the board, or to a terminal, the wire should be firmly held by the solder. Try moving wires and leads in the solder connection (only after the solder has cooled); if any wire moves in a connection, reheat the solder.

4. Do not allow solder to flow from one foil area to another (or between terminals). If there is solder between connections, remove it carefully with the freshly-cleaned, hot tip of your soldering iron.

Before you start construction, check the contents of your kit against the Parts List.

Much of the wiring of your kit is done on and by the printed circuit board. The top of the board has the parts outline and symbol numbers; mount the parts on this side. The other side has a metal foil pattern, which takes the place of wires between parts. Solder the leads of the parts to the foil areas.

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THIS KIT MUST BE PROPERLY SOLDERED

USE ENOUGH HEAT

This is the main idea of good soldering. Apply enough heat to the metal surfaces you are joining to make the solder spread freely.

You are not using enough heat if the solder barely melts and forms a rounded ball of rough, flaky solder.

Use the Right Soldering Tool

A soldering iron in the 20-40 watt range is recommended. Any iron in this range with a clean pencil-type tip will supply the correct amount of heat to make a good solder connection.

Keep the iron tip brightly coated with solder. When necessary, wipe the hot iron tip with a cloth. If you are using an old tip, clean it before you start soldering.

Use Only Rosin Core Solder

We supply the right kind of solder.

HERE'S HOW TO DO IT . . .

1. Join bare metal to bare metal. Make good mechanical connections and keep leads as short as possible.

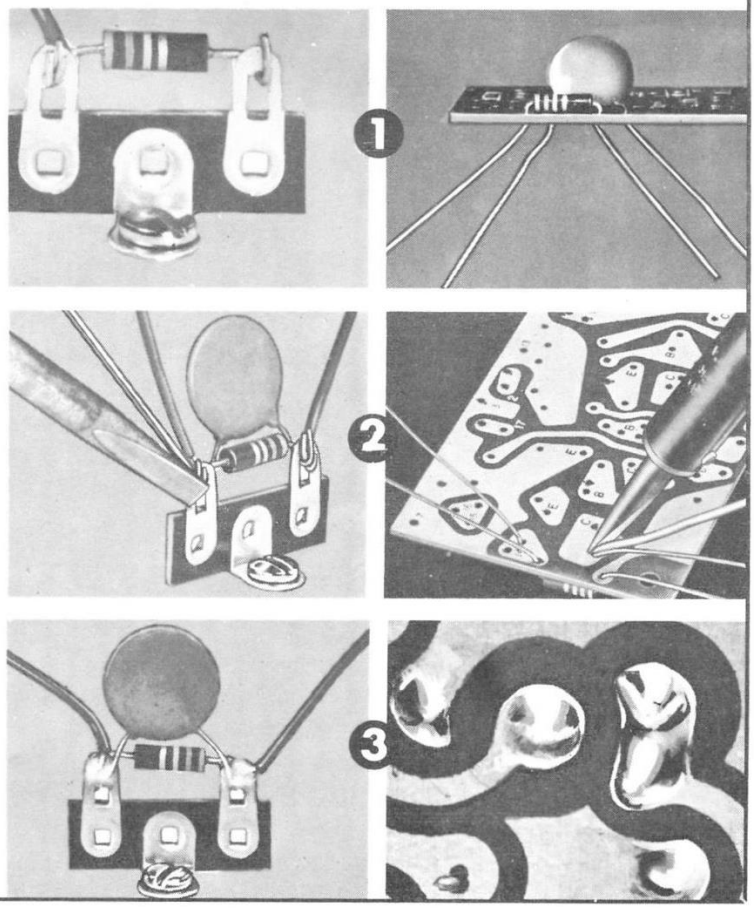
2. Coat the tip of your hot iron with solder. Then **Firmly Press the Tip** against the parts to be soldered.

Apply the solder between the metal to be soldered and the iron tip. Use only enough solder to flow over all surfaces and wires in the connection. Remove the iron.

If you accidentally move the wires as the solder is hardening, apply your iron and reheat.

3. Compare your soldering with these pictures. The connection is good if: solder flowed over all surfaces to be connected, it appears smooth and bright and all wires are held firmly by solder.

You Have Not Used Enough Heat: If your connection is rough and flaky-looking, or if the solder has formed a round ball instead of spreading.



MOUNTING PARTS

SEE FIGURE 1.

NOTE: To help you in orienting parts and positioning, you may find it helpful to look over to Figure 2 also.

☐ Mount the Spacers on the back side of the front panel using two round-head screws. Insert the screws from the front of the panel and thread the spacers onto the screws from the back of the panel (the screw holes are the small round ones near the edge of the large speaker mounting hole).

☐ From the front of the panel, carefully position the speaker down over the large round hole (position so the terminals will be as shown in Figure 2). Position the grill down over the front of the speaker, then place the square metal frame down over the grill and speaker. The four metal tabs on the frame must be inserted through the slots in the panel; bend the tabs over on the back of the panel to hold the speaker, grill and frame in place.

☐ Locate the sub-plate and note that the four small holes have been counter-bored on one side of the plate (dimple drilled out for screw-head to fit into); the screw heads must fit down into these. Using the four flat head screws, mount S-1 slide switch and the battery holder for B-2. You may want to refer to Figure 2 also.

☐ Mount the sub-plate to the back of the panel using VR-1 control as shown. Note the locating tab on the side of VR-1; bend over as shown. Fasten VR-1 from the front of the panel with the flat washer and nut. Be sure the terminals of VR-1 are positioned as shown in Figure 2. Note: If a large lockwasher is supplied, mount it over the shaft of VR-1; **place it between the sub-plate and the panel.**

☐ Refer to Figure 1 and mount the four jacks as shown; be sure the shouldered side of the fiber washer fits into the hole in the panel. Use the black jacks for the "COM" jacks (see front of panel) and use the red jacks for the remaining jacks. Position the solder lugs as shown in Figure 2, and bend them away from the panel and sub-plate.

☐ Before you go on, be sure all the mechanical parts are tightened securely.

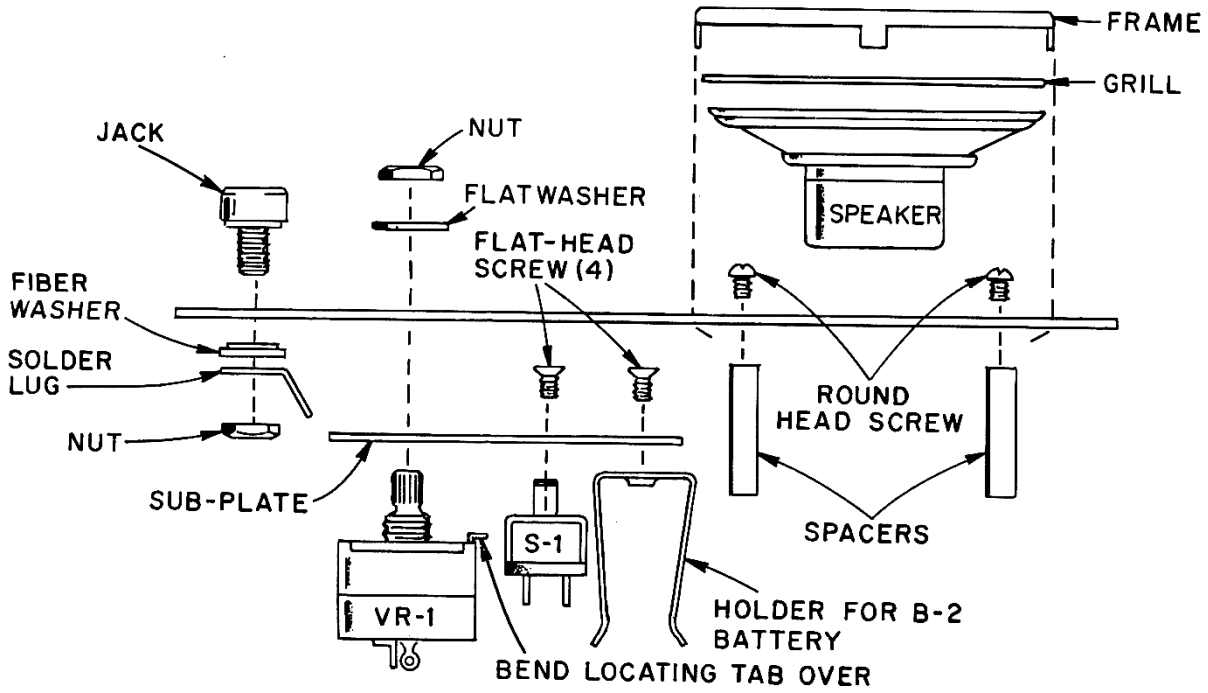

FRAME
GRILL
SPEAKER
JACK
NUT
FLAT WASHER
FLAT-HEAD
SCREW (4)
FIBER
WASHER
SOLDER
LUG
NUT
SUB-PLATE
ROUND
HEAD SCREW
SPACERS
S-1
VR-1
HOLDER FOR B-2
BATTERY
BEND LOCATING TAB OVER

FIGURE 1

MOUNTING PARTS AND FIRST WIRING

SEE FIGURE 2.

☐ Press the grommet into the hole shown.

☐ Screw the pilot lamp into the socket. Carefully press the lamp into the grommet so the terminals are positioned as shown.

☐ S-2 push button switch. Thread one nut over the bushing of S-2; mount from the back of the panel in hole labeled "Push On". Fasten from the front with a flat washer and nut. Position the terminals as shown.

☐ Phone jack. Thread a nut over the threaded bushing. Then mount the phone jack from the back of the panel and fasten from the front with a flat washer and nut. Position the terminals as shown.

☐ Cut a 4" piece of blue wire. Remove ¼" of insulation from each end. Solder one end to terminal 3 of the Phone Jack. Connect (do not solder yet) the other end to terminal 1 of the Speaker.

☐ Cut a 3" piece of green wire. Remove ¼" of insulation from each end. Solder one end to terminal 2 of the Phone Jack. Solder the other end to terminal 2 of the speaker.

☐ Cut 1½" of red wire. Remove ¼" of insulation from each end. Solder one end to terminal 2 of S-2. Connect (do not solder yet) the other end to terminal 1 of the Pilot Lamp Socket.

☐ 2¾" piece of bare wire. Thread through terminal 2 of the Pilot Lamp Socket, terminal 4 of VR-1 and the solder lugs of Jacks #2 and #3. Solder 2 of the Pilot Lamp Socket and the solder lug of Jack #2. Do not solder the other terminals yet.

☐ Cut 1½" of black wire and remove ¼" of insulation from each end. Connect one end (do not solder yet) to terminal 1 of VR-1. Solder the other end to the solder lug of Jack #3 (there will be two wires in this connection).

☐ Cut a 3" piece of yellow wire and remove ½" of insulation from one end. Solder this end to terminals 2 and 5 of S-1. Remove ¼" of insulation from the other end and solder to the solder lug of Jack #4.

☐ C-11, 100 pf capacitor. Cut each lead to about ½". Connect one lead (do not solder yet) to terminal 1 of VR-1 and the other lead to terminal 3 of VR-1 (do not solder yet).

☐ Compare your unit with Figure 2. Be sure all the parts and wires are in place as shown.

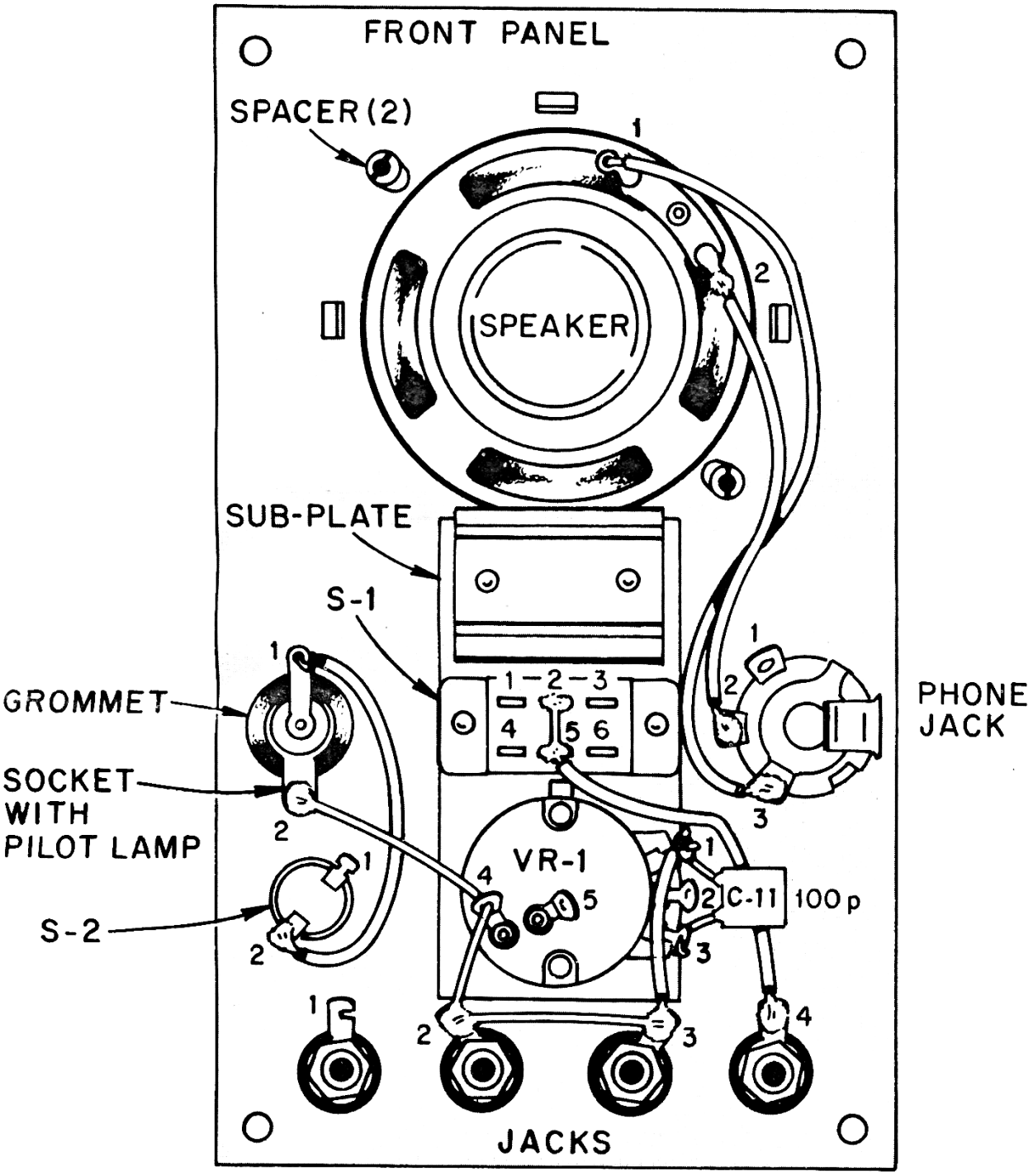

FRONT PANEL
SPACER (2)
SPEAKER
SUB-PLATE
S-1
1-2-3
4 5 6
GROMMET
SOCKET WITH PILOT LAMP
S-2
VR-1
C-11
100 p
PHONE JACK
JACKS

FIGURE 2

FIRST MOUNTING OF PARTS ON THE PRINTED CIRCUIT BOARD

SEE FIGURE 3.

☐ Position the printed circuit board in front of you as shown; parts outline side up. The illustration is shown actual size, thus you can use it as a template to aid you in identifying the correct holes and parts.

As you mount parts, be sure you correctly identify each hole for each lead.

Mount the following group of parts:

☐ R-12, 82K resistor with gray, red and orange color bands (the fourth color band will not be noted unless it is gold). Mount as illustrated on page 2.

☐ R-11, 10 ohm resistor (brown, black, black).

☐ R-9, 120 ohm resistor (brown, red, brown).

☐ R-8, 2.7K resistor (red, violet, red).

☐ R-10, 500 ohm resistor (green, black, brown).

☐ R-7, 330 ohm resistor (orange, orange, brown).

☐ Turn the board over and carefully solder each lead of each part right at the point where the lead comes through the hole in the foil. Cut off excess lead ends. Be sure no solder flows across betwen adjacent foil areas.

Mount the following group of parts.

☐ R-6, 10K resistor (brown, black, orange).

☐ R-4, 330 ohm resistor (orange, orange, brown).

☐ R-2, 3.3K resistor (orange, orange, red).

☐ R-5, 30K resistor (orange, black, orange).

☐ R-3, 4.7K resistor (yellow, violet, red).

☐ R-1, 100K resistor (brown, black, yellow).

☐ Turn the board over and solder each lead of each part right at the point where the lead comes through the hole in the foil. Cut off excess lead ends.

☐ TH-1 thermistor (this is a small disc with two thin leads coming from the sides). This part may be identified as MT-250. Mount where shown; turn the board over and solder both leads. Cut off the excess wire ends.

The next parts you are going to mount are transistors. It is vital that you correctly identify the leads and that they are inserted into the proper holes in the printed circuit board. Note that each transistor has a number on it; be sure to use the correct transistor for each step.

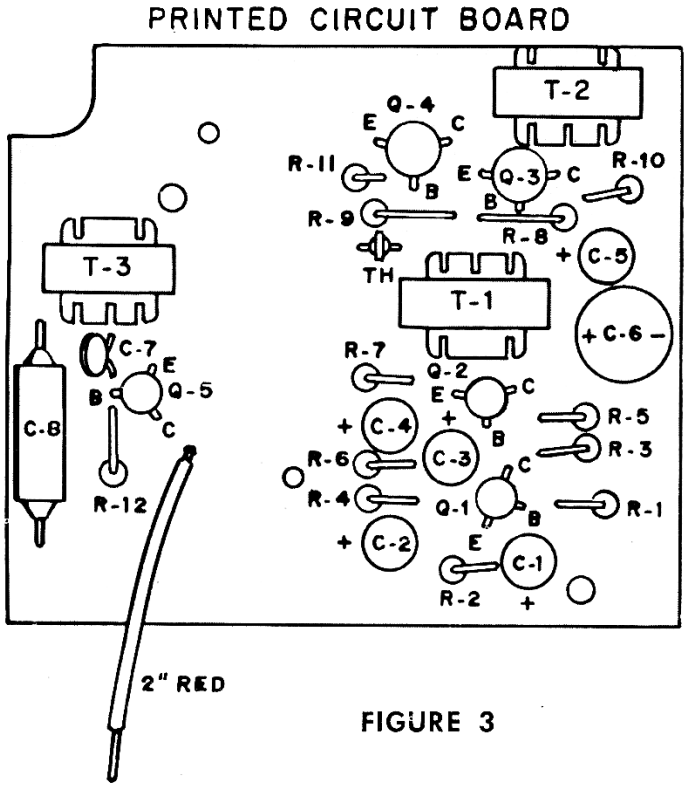


FIGURE 3

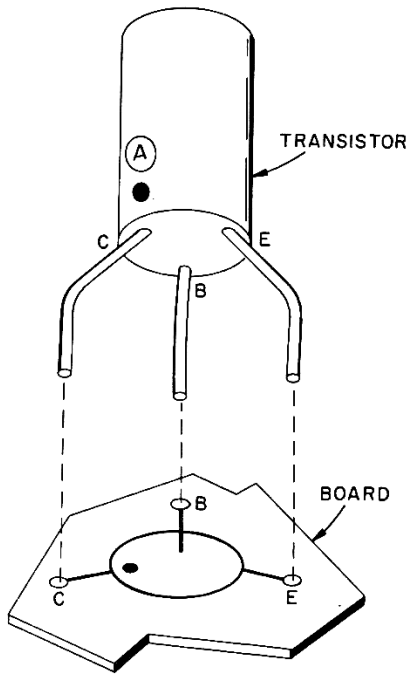


FIGURE 4

☐ See Figure 4. Pick up any of the transistors and note how the leads come out of the case as shown in Figure 4; they are positioned in a triangular group. Notice that on one side of the case, there is a color dot or stripe, or a symbol. This identifies the side next to the "C" (collector) lead. As you pick up each transistor, be sure to identify the "C" lead by the dot or symbol, then orient the transistor so you can identify the other leads. Then mount the transistor. Look at Figure 3 to determine the proper hole for each lead.

☐ Q-1, 2SB175 transistor. Identify each lead and insert them into the correct holes. Mount the transistor about 3/8" above the printed circuit board. Turn the board over and solder each lead to its foil area; cut off the excess.

☐ Q-2, 2SB175 transistor. Identify each lead and insert them into the correct holes. Mount the transistor about 3/8" above the printed circuit board. Turn the board over and solder each lead to its foil area; cut off the excess.

☐ Q-3, 2SB187 transistor. Identify each lead and insert them into the correct holes. Mount so the transistor is about 3/8" above the board. Solder the leads on the foil side and cut off the excess.

☐ Q-4, 2SB187 transistor. Identify each lead and insert them into the correct holes. Mount so the transistor is about 3/8" above the board. Solder the leads on the foil side and cut off the excess.

☐ Q-5, 2SA101 transistor. Identify each lead and insert them into the correct holes. Mount so the transistors is about 3/8" above the board. Solder each lead on the foil side and cut off the excess.

☐ Now check each transistor to be sure you have properly identified each lead, and that they are in the correct holes. Be sure the leads are not crossed over, or touching each other.

SECOND MOUNTING OF PARTS ON THE PRINTED CIRCUIT BOARD

SEE FIGURE 5.

☐ C-8, 0.002 μf capacitor. Mount where shown.

☐ C-7, 0.01 μf disc capacitor. Mount where shown.

☐ Turn the board over and solder both leads of both of these parts directly to the foil area where the lead comes through. Cut off the excess.

The next parts you are going to mount are electrolytic capacitors. They have two leads; one of them is a + lead, the other is —. You must insert the + and — leads into the correct holes. There are markings on the side of the capacitor, identifying either or both leads; also, the + lead is always longer than the — lead.

☐ C-5, 50 μf capacitor. Identify the + lead and insert through the hole identified with a + mark.

☐ C-6, 100 μf capacitor. Identify the + lead and insert through the hole identified with a + mark.

☐ C-4, 10 μf capacitor. Be sure to identify the + lead.

☐ C-3, 10 μf capacitor. Be sure to identify the + lead.

☐ C-2, 10 μf capacitor. Be sure to identify the + lead.

☐ C-1, 10 μf capacitor. Be sure to identify the + lead.

☐ Turn the board over and solder each lead of each part directly at the foil area where the lead comes through. Cut off the excess lengths.

☐ T-1 transformer with blue insulation (or paint). This part may be identified as T-602. Note there are three leads coming from one side, and two from the other. Be sure to position the transformer so the leads go directly through the holes provided in the board (do not let them touch each other or cross over each other). Mount T-1 and bend the tabs over on the foil side as shown in the detail. Solder each lead and the tabs to the adjacent foil areas. Cut off excess wire ends.

☐ T-2 transformer with red insulation (or paint). This part may be identified as T-601. Mount where shown, with the side with three leads positioned as shown. Be sure each lead goes directly through the appropriate hole in the board. Bend over the mounting tabs as shown and solder leads and tabs to the foil area. Cut off excess wire ends.

☐ T-3, transformer with yellow insulation (or paint). This part may be identified as TE-7. Note on the top there are three slots on one side, two slots on the other; position so the side with three slots is next to C-7. Bend the tabs over on the foil side and solder each wire and the tabs. Cut off the excess wire ends.

☐ Cut a 2" red wire. Remove ¼" of insulation from each end and insert one end into the hole shown (identified as hole 9 on the foil side). Solder this end on the foil side. The other end will be connected later.

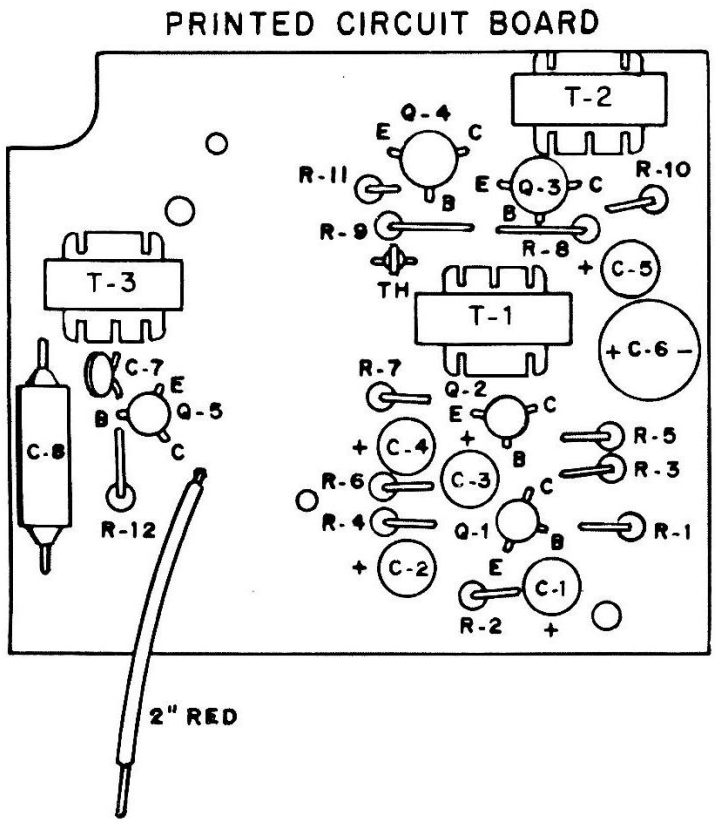
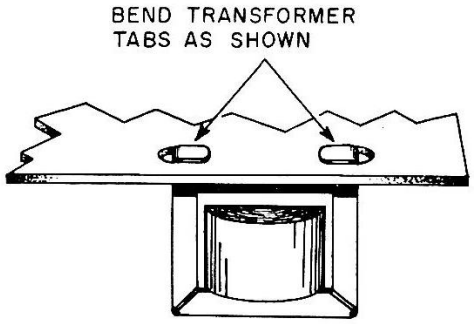


FIGURE 5



☐ Before you go on, carefully check the printed circuit board:

1. Be sure all parts are mounted.

2. Are all leads soldered?

3. Be sure there is no solder which has run across between adjacent foil areas, or wire ends which touch each other. Cut off any wire ends. Use the hot tip of your soldering iron to draw away any solder which has crossed between foil areas.

4. Do all solder connections have a shiny, metallic finish? Reheat any questionable connections.

SOLDERING WIRES TO THE FOIL SIDE OF THE BOARD

SEE FIGURE 6.

☐ Turn the printed circuit board over so the foil side is facing you as shown.

☐ Cut a 4" green wire. Remove ¼" of insulation from each end. Solder one end to point #1 on the foil side; the other end will be connected later.

☐ Cut a 2" blue wire. Remove ¼" of insulation from each end. Solder one end to point #2 on the foil side; the other end will be connected later.

☐ Cut a 1" yellow wire. Remove ¼" of insulation from each end. Solder one end to point #3 on the foil side; the other end will be connected later.

☐ R-14, 4.7K resistor (yellow, violet, red). Slip 1¼" of tubing over each lead. Solder one lead to point #5 on the foil side; the other lead will be conected later.

☐ Cut a 4" black wire. Remove ¼" of insulation from each end. Solder one end to point #6 on the foil side. The other end will be connected later.

☐ Cut a 3" yellow wire. Remove ¼" of insulation from each end. Solder one end to point #8 on the foil side. The other end will be connected later.

☐ Battery holder for B-1. Refer to Figure 7 for a top view of this part. Position as shown in Figure 7 (+ and — ends as shown) and mount on the parts side of the printed circuit board, using two round head screws inserted up through the foil side and threaded into the holes on the holder.

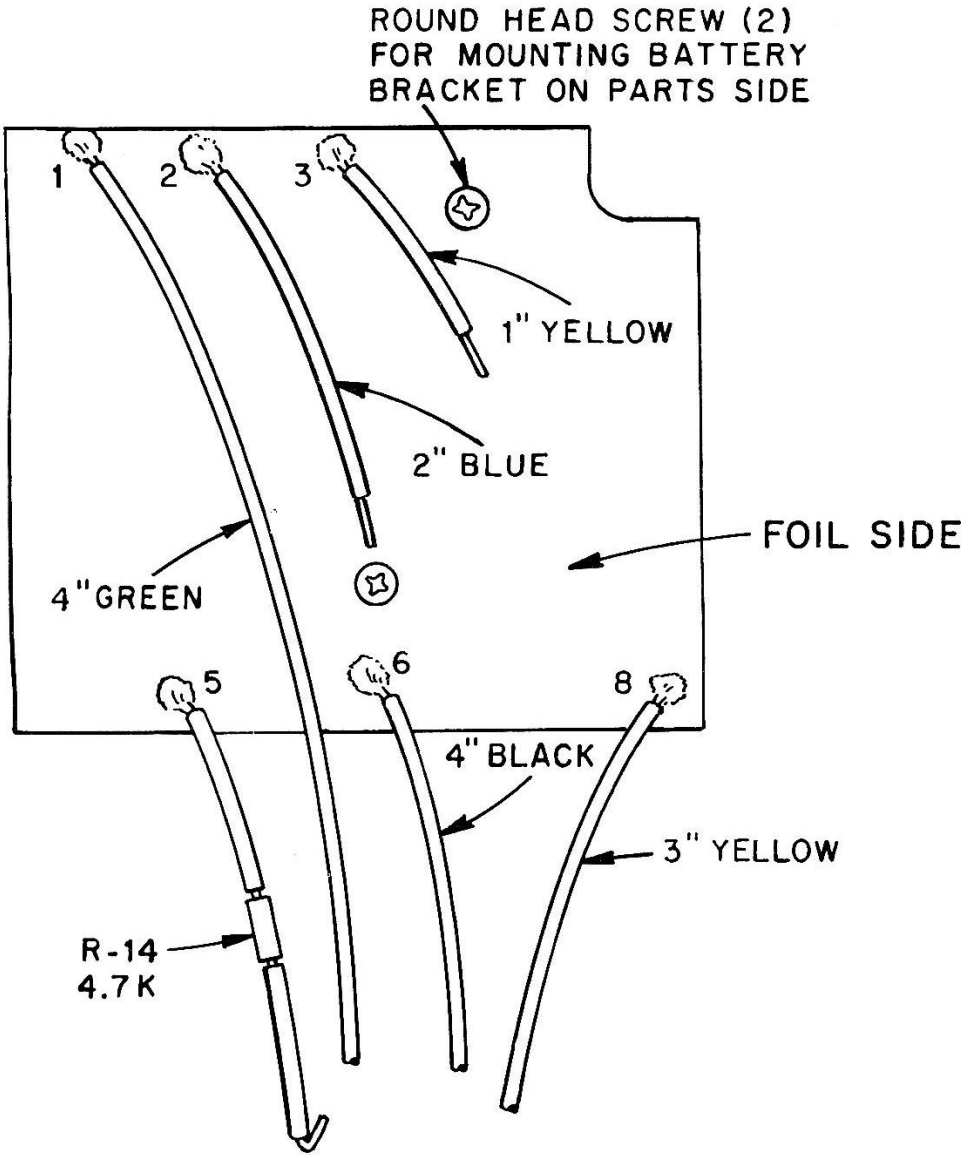

ROUND HEAD SCREW (2)
FOR MOUNTING BATTERY
BRACKET ON PARTS SIDE
1
2
3
1" YELLOW
2" BLUE
FOIL SIDE
4"GREEN
5
6
8
4" BLACK
3" YELLOW
R-14
4.7K

FIGURE 6

FINAL WIRING

SEE FIGURE 7.

☐ Position the printed circuit board above the speaker as shown. Before you mount it in place, solder the end of the 2" blue wire (from #2 on the foil side) to terminal 1 of the speaker (there will be two wires in this connection). Now mount the board with two round-head screws inserted down through the board and threaded into the tops of the spacers.

☐ Solder the end of the 1" yellow wire (from #3 on the foil side) to terminal 1 of the Holder for B-1 battery.

☐ Solder the end of the 3" yellow wire (from #8 on the foil side) to the solder lug of Jack #1.

☐ Solder the end of the 4" black wire (from #6 on the foil side) to terminal 1 of VR-1 (there will be 3 wires in this connection).

☐ Solder the free lead of R-14 to terminal 2 of VR-1.

☐ Solder the free end of the green wire (from #1 on the foil side) to terminal 1 of the Phone Jack.

☐ Solder the free end of the red wire from the top of the board to terminal 1 of the Pilot Lamp socket (there will be 2 wires in this connection).

☐ Cut a 3½" red wire. Remove ¼" of insulation from each end. Solder one end to terminal 2 of the Holder for B-1. Solder the other end to terminal 1 of S-2.

☐ C-10, 0.005 μf capacitor. Insert one lead through terminals 1 and 4 of S-1 and solder both terminals. The other lead of C-10 will be connected later.

☐ R-13, 100K resistor (brown, black, yellow). Cut each lead to about ½". Solder one lead to terminal 4 of VR-1 (there will be 2 wires in this connection). The other lead will be connected later.

☐ CR-1 diode. Note that one end has a band, color stripe, or an arrow symbol as shown. Connect the diode into the circuit with the marked end, or symbol, positioned as shown. Connect the marked end to terminal 3 of VR-1 (no not solder yet). Wrap the lead from the other end together with the free leads from C-10 and R-13. Make a solder connection and cut off excess lead ends. This connection must not touch other terminals, or other parts (you may want to cover this connection with a piece of tape).

☐ C-9, 0.005 μf capacitor. Insert one lead through terminals 3 and 6 of S-1; solder both terminals. Slip ½" tubing over the other lead and solder to terminal 3 of VR-1 (there will be 3 wires in this connection).

☐ Battery connector for B-2. Solder the red lead to terminal 5 of VR-1. Solder the black lead to point #4 on the printed circuit board.

This completes the wiring and soldering of your kit. Before you go on, we suggest you check the following:

1. Are all the connections soldered properly? Reheat any questionable connections (adding a little solder if necessary).

2. Be sure each wire is firmly held by each solder connection. Try moving wires in the connection; if any wire moves in the solder connection, that connection must be reheated.

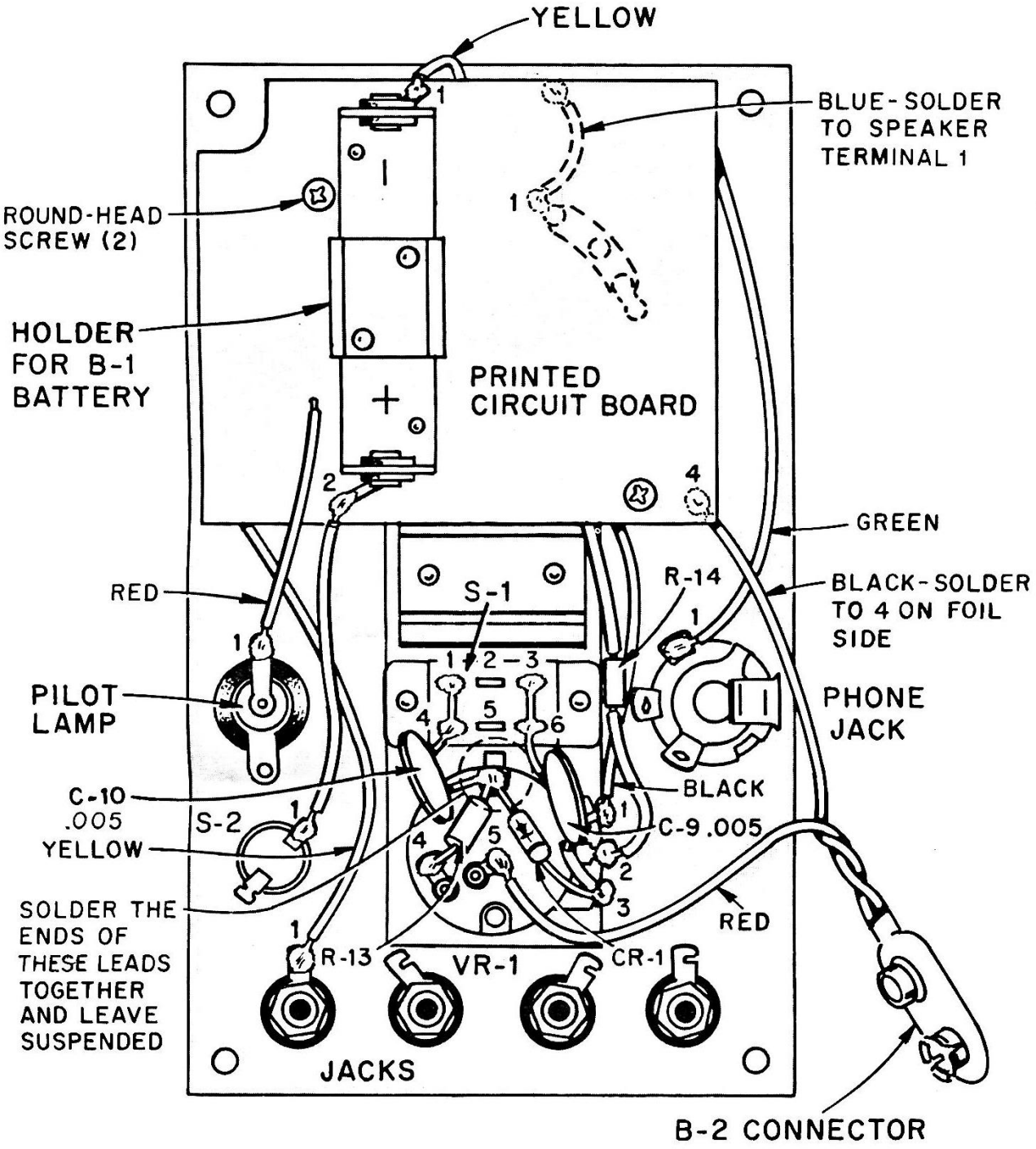


FIGURE 7

☐ Snap the B-2 connector over the 9-volt battery and press the battery down into the clip for B-2.

☐ Press the 1½-volt battery into the holder on the board—be sure the + end (nib) is against the + terminal.

☐ You can mount the unit into the case using four screws. Rotate shaft of VOL SW control maximum counterclockwise. Place the knob over the shaft so the dot is positioned next to OFF; tighten the set screw.

CONTROL FUNCTIONS

This brief description of each control and its function will help you understand and use your instrument to its fullest extent.

Vol SW: is the Volume control and On-Off switch for the Signal Tracing function. Turn maximum counterclockwise to turn the Signal Tracer Off. Adjustment of this control determines the loudness of the signal which you hear through the built-in speaker (or headphones if you are using them).

Phone jack: plug headphones into this jack if you want to listen to the tracer with earphones. This will be particularly useful when checking a unit in a high-noise level area. The built-in speaker is automatically disconnected when the plug is inserted into the Phone jack.

AF/RF switch: is used only for the Signal Tracer function. In the AF position, the tracer will check for Audio signals; in the RF position, a diode is inserted into the input of the tracer circuit, and you can trace Radio Frequency signals.

Pilot Lamp: indicates when the Injector circuit is on. It also serves as a battery check for the 1½-volt battery which is used to power the Injector circuit.

Push On switch: this push-button switch is used to turn the Injector circuit on. When this button is pushed in, the pilot lamp should light up.

Tracer jacks—Input and Com: plug cables into these two jacks for the Tracer function. The Com jack (common) should be connected to the chassis or common side of the circuit under test. The Input jack should be connected to the active point in the circuit under test.

Injector jacks—Output and Com: plug cables into these two jacks for the Injector function. The Com jack (common) should be connected to the chassis or common side of the circuit under test. The Output jack should be connected to the point where you want to inject the signal.

Note: The two Com jacks are connected together internally.

HOW TO USE YOUR SIGNAL INJECTOR/TRACER

We will give step-by-step instructions for each function in this next section. Later on, we will illustrate a method of application and use.

TO USE THE SIGNAL TRACER FUNCTION

The Signal Tracer is basically a substitution amplifier (using four transistors). A diode can be switched in and out of the input circuit to this amplifier, so it can function to amplify Audio signals (no diode) or Radio Frequency signals (diode is switched into the circuit to act as a detector). This amplifying circuit can be connected into a circuit under test to see what sections are operating correctly, and where the signal path ceases or is defective.

☐ Plug test leads into the Tracer jacks: black to black and red to red. You can use either the test prod leads or the leads with the clips on the ends.

☐ Connect the other ends of the test leads to the circuit under test. Connect the black lead to the chassis or common side of the circuit. Connect the red lead to the first point in the circuit which you want to check.

☐ If you are tracing in an RF or IF circuit, set the AF/RF slide switch to RF. If you are checking in an audio circuit, use the AF position.

☐ Turn on power to the unit under test. Energize your Signal Tracer by turning VOL SW control clockwise and advance about half-way.

☐ If you are testing a radio, adjust the Tuning control until you hear a signal from the built-in speaker in your Signal Tracer.

☐ Continue your signal tracing function through the unit under test. For tracing, you always start close to the input section of the unit under test and work back towards the output section.

Notes: If you are not using the Signal Tracer, set VOL SW to Off to conserve battery power.
If you prefer to use earphones for listening to the circuit under test, plug them into the PHONE jack. Earphones are particularly helpful when you are working in an area where there is much noise, or if the speaker on the radio (or other unit under test) does work, but there is some source of distortion or other problem which you are tracing.

TO USE THE SIGNAL INJECTOR FUNCTION

The Signal Injector is basically a simple oscillator. This oscillator uses a single transistor to generate a signal in the 600 to 1000 Hz range which is very rich in harmonics, thus resulting in signals well up into the RF range. The output can be used to check either Radio Frequency circuits or Audio Frequency circuits.

☐ Plug test leads into the Injector jacks: black to black and red to red. You can use either the test prod leads or the leads with the clips on the ends.

☐ Connect the other ends of the test leads to the circuit under test. Connect the black lead to the chassis or common side of the circuit. Connect the red lead to the first point in the circuit which you want to check.

☐ Turn on power to the unit under test. To operate the Signal Injector (that is, to produce the test signal), press the PUSH ON switch. A tone will be heard in the speaker of the unit under test, if that portion of the unit is working correctly.

☐ Continue your signal injecting tests through the unit which you are checking. For signal injecting, you always start close to the output section of the unit under test, and work towards the input circuitry.

Notes: The pilot lamp should light up when you press the PUSH ON button; if it does not, you should replace the 1½-volt battery mounted in the clip on the printed circuit board.

TO USE THE SIGNAL TRACER TOGETHER WITH THE SIGNAL INJECTOR

One of the unique features of your instrument is that both functions can be used at the same time. Thus, you can inject a signal into the first stage of a unit under test and can use the Signal Tracer to trace through the circuit. The two functions can also be used to check small portions of a circuit for continuity and/or complete signal paths.

☐ Plug a pair of test leads into the Tracer jacks and another pair into the Injector jacks (it is not really necessary to use both COM jacks, for they are connected together; as long as the common leads normally are connected to common electrical circuit points).

☐ Connect the Tracer leads to the points where you want to check for signal. Connect the Injector leads to the points where you want to inject a signal.

☐ Turn on power to the unit under test. Adjust VOL SW to about ½ rotation. Press PUSH ON button. You should hear the test tone in the built-in speaker in your Signal Injector/Tracer.

Note: If the speaker in the unit under test is operating, you will want to use earphones with your Signal Injector/Tracer (thus the sound from the speaker will not bother you).

Sample Illustration of Use

To aid you in the use and application of your Signal Injector/Tracer, this section of the manual will give you an illustration of how it may be used. Below is a sample schematic of a fairly typical transistor radio (the Knight-Kit RANGER IV). It will be used for this example.

This radio uses 6 transistors;

TR-1 is the Radio Frequency Converter

TR-2 is the First Intermediate Frequency Amplifier

TR-3 is the Second Intermediate Frequency Amplifier

These three stages can be considered as the RF and IF portions.

The last three transistors are used to amplify the audio signals.

TR-4 is the Audio Frequency Driver Amplifier

TR-5 and TR-6 are the Audio Output Amplifier transistors

You will note we have marked test points throughout the schematic diagram with letters (A through Q) which have been circled.

Signal Tracing the Circuit

If the Radio does not operate at all, you can use the Signal Tracer function to check through the circuit. To trace the circuit from the beginning, proceed as follows (using step-by-step instructions previously given):

For convenience, use a test prod lead for the Tracer Input jack (and a clip lead for the Common jack).

You should start tracing from point C, D or E. Your Signal Tracer does not have adequate gain in the RF range to be able to take a signal directly from the antenna circuit and produce a usable output signal.

Place your test probe on point C (or start with D or E); set the RF/AF switch to RF and set VOL SW to maximum. Turn the radio on (be sure the batteries are good), and adjust the tuning control on the radio. If you hear a radio station, you know that the circuit is OK from point A to point C. Move the probe to point D; if you hear the signal, you know that portion of the circuit is OK.

MAINTENANCE

Once you have built your Signal Injector/Tracer correctly, there is very little that can go wrong with it. Periodically you will have to replace batteries (see Battery Checking below).

If your unit does not operate properly after construction, very carefully go back over all the construction. Be sure all connections are properly soldered. Be sure all parts are in the proper place. Be sure each transistor has been installed correctly and that the + and — markings on the capacitors are in the correct place.

Battery Checking

Check the batteries as follows:

The 1½-volt battery is used only for the Injector function. When you press the PUSH ON button, the pilot lamp should light up. If the light does not come on (or it is very dim), replace the 1½-volt, type AA penlight battery mounted on the printed circuit board.

The 9-volt battery is used only for the Tracer function. Connect the TRACER INPUT lead and the INJECTOR OUTPUT lead together. Set VOL SW at mid-point and press PUSH ON button. If you hear the test tone from the built-in speaker, the 9-volt battery is OK. If you do not hear the test tone, replace the 9-volt battery (use a standard 9-volt transistor radio battery such as Burgess 2U6, RCA VS323, Eveready 216, Ray-O-Vac 1604).

To aid in troubleshooting your unit, here are some typical voltage readings (refer to the schematic diagram of the Signal Injector/Tracer):

Q-1 Transistor: Base = 0.2 volt, Emitter = 1.0 volts, Collector = 4.2 volts

Q-2 Transistor: Base = 1.7 volts, Emitter = 1.5 volts, Collector = 4.0 volts

Q-3 Transistor: Base = 0.25 volt, Emitter = 0.06 volt, Collector = 9 volts

Q-4 Transistor: Base = 0.25 volt, Emitter = 0.06 volt, Collector = 9 volts

Q-5 Transistor: Base = 1.35 volts, Emitter = 1.5 volts, Collector = no reading

Thus, you continue to work back through the circuit. If you lose the signal anywhere, the problem is between that point and the last point you checked.

Note: When you move past point I, set the RF/AF switch to AF (you are now in the audio portion of the circuit). Also, as you move back through the circuit, you will have to reduce the setting of the VOL SW control.

To isolate the exact problem, once you have found the stage where the problem is, you can use a VOM or other test instrument. Or, you can use your Signal Injector/Tracer to check each part for signal continuity.

Thus, you can see that you can trace back through the circuit all the way from point C to point Q.

Injecting a Signal into the Circuit

You can use the Signal Injection function instead of the Signal Tracing function if you prefer. The Injector is used from the other end of the circuit (start from the output and work back toward the input).

Use a test prod for the Injector Output jack and a clip lead for the Common jack. Follow the step-by-step instructions provided earlier for using the Injector function.

Start at point L (you **may** be able to get a signal through from points N or M). Your Signal Injector does not have adequate power to drive the output stage or the speaker by itself; thus, to check from points L through Q, you should use the Tracer function (or a combination of the two functions).

If you hear the test tone from the speaker in the radio, you know that the circuit is OK from point L on to the speaker. Now, move the probe to point K; if you still hear the sound, you continue to work through the circuit—from point K to J, to I, to H, etc.

At the point where you lose the test tone, you know the problem is between that point and the last point where you did hear the test tone.

You can check the circuit all the way up to point A using the Signal Injector.

Note: As you work your way through the circuit, the sound from the speaker of the radio should become louder and louder.

Using Both Tracer and Injector Functions

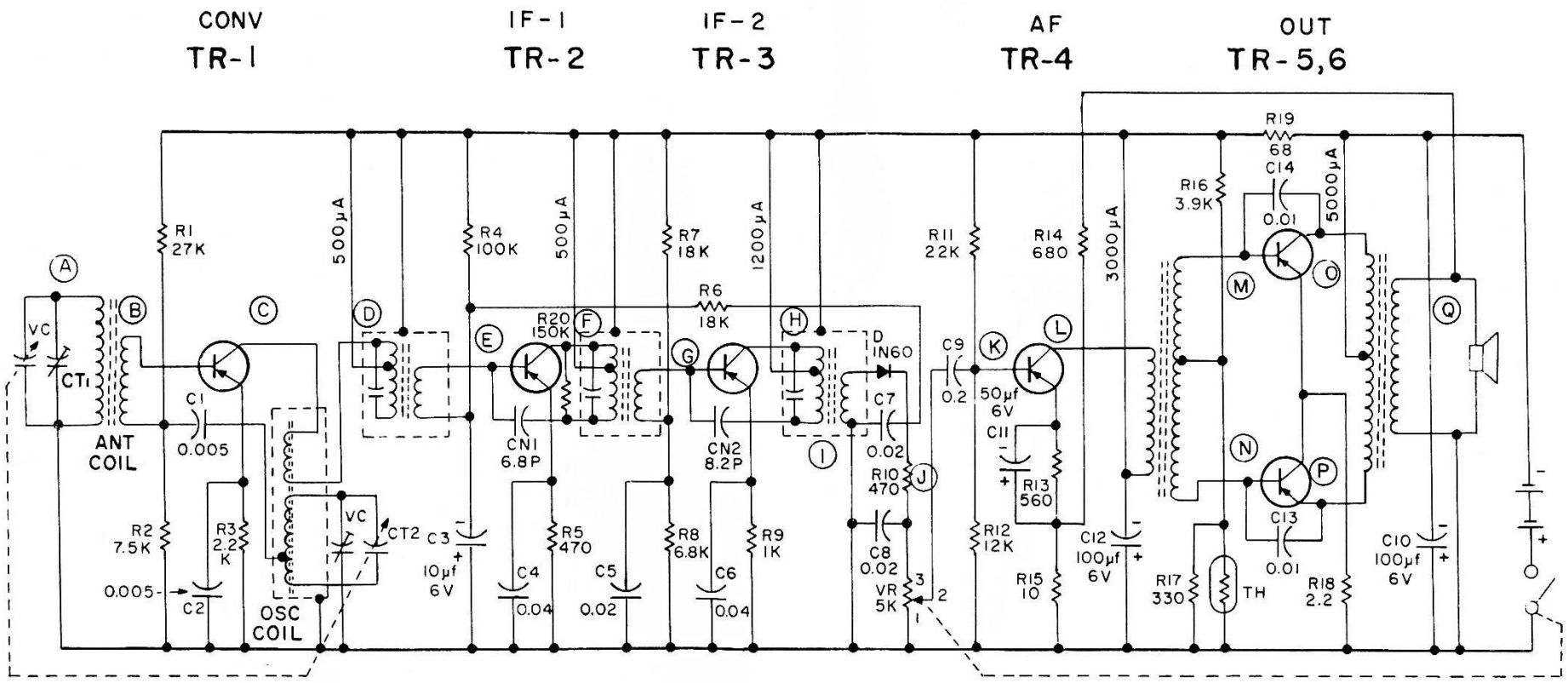
You can check sections of the circuit using both functions.

For example, Inject a signal into the circuit at point A and use the Tracer at point B (or C or D, etc.) to check that part of the circuit.

Thus, you can Inject a signal at the input and trace it all the way back through the circuit from B all the way to Q. Or, you can check just a small portion of the circuit; Inject a signal at point H and use the Tracer to check at point I, J, K or L, etc.

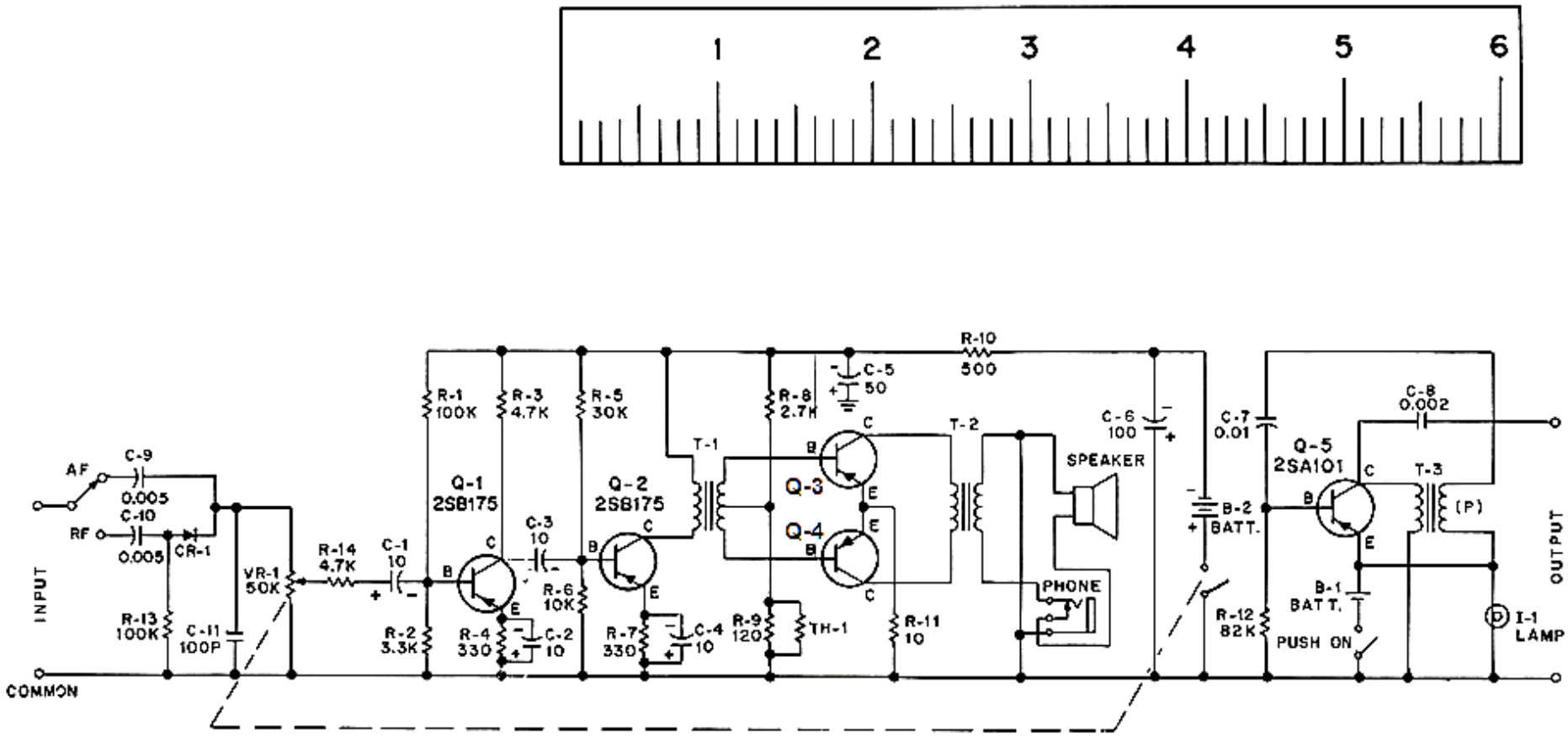
Or use it just to check one part, such as the Driver Transformer (IPT on the schematic) by Injecting the signal at point L and using the Tracer at point M and N to see if the transformer is OK.

As you become familiar with your Signal Injector/Tracer, you will see just how handy it can be to check almost any signal circuit.



NOTES: ALL RESISTANCE VALUES ARE GIVEN IN OHMS.
ALL CAPACITANCE VALUES ARE GIVEN IN MICROFARADS.
K=1,000 OHMS
$P = \frac{1}{1{,}000{,}000}\ \mu f$

SAMPLE RADIO SCHEMATIC



Schematic Diagram

KG-679

PARTS LIST

Symbol	Description	Part Number
	BATTERIES	
B-1	1.5 volt, type "AA" (penlight)	K504-103
B-2	9 volt	K504-102
	CAPACITORS	
C-1	10 μf, 10-volt electrolytic	D604-303
C-2	10 μf, 10-volt electrolytic	D604-303
C-3	10 μf, 10-volt electrolytic	D604-303
C-4	10 μf, 10-volt electrolytic	D604-303
C-5	50 μf, 10-volt electrolytic	D604-304
C-6	100 μf, 10-volt electrolytic	D604-305
C-7	0.01 μf, 50-volt ceramic disc	D604-306
C-8	0.002 μf, 400-volt oil filled	D604-307
C-9	0.005 μf ceramic disc	D604-308
C-10	0.005 μf ceramic disc	D604-308
C-11	100 pf ceramic disc	D604-309
	DIODE	
CR-1	MD-34 or G-1010	A604-175
	LAMP	
I-1	3-volt	F604-172
	RESISTORS	
	All resistors are ¼-watt, 10%, carbon, unless otherwise indicated.	
R-1	100K	B510-100K
R-2	3.3K	B510-3.3K
R-3	4.7K	B510-4.7K
R-4	330 ohm	B510-330
R-5	30K	B510-30K
R-6	10K	B510-10K
R-7	330 ohm	B510-330
R-8	2.7K	B510-2.7K
R-9	120 ohm	B510-120
R-10	500 ohm	B510-500
R-11	10 ohm	B510-10
R-12	82K	B510-82K
R-13	100K	B510-100K
R-14	4.7K	B510-4.7K
VR-1	50K control with switch (with mounting hardware)	C604-145
	SPEAKER	
SP-1	8-ohm, 2" loudspeaker	L604-117
	SWITCHES	
S-1	AF/RF, slide switch	E604-146
S-2	PUSH ON, push button switch	E604-147
Tubing, 5"	1	

PARTS LIST

THERMISTOR

TH-1 MT-250 ..... A604-176

TRANSFORMERS

T-1 Driver transformer, blue (T-602) P604-190
T-2 Output transformer, red (T-601) P604-191
T-3 Oscillator transformer, yellow (TE-7) P604-192

TRANSISTORS

Q-1 2SB175 ..... A604-112
Q-2 2SB175 ..... A604-112
Q-3 2SB187 ..... A604-177
Q-4 2SB187 ..... A604-177
Q-5 2SA101 ..... A604-178

Description	Quantity	Part Number

MISCELLANEOUS

Case	1	S604-137
Connector for B-2 battery	1	K604-439
Frame for speaker grill	1	K604-440
Grill, speaker	1	K604-441
Grommet	1	F604-173
Holder for B-1 battery	1	K604-442
Holder for B-2 battery	1	K604-443
Jack, phone (with hardware)	1	F604-174
Jack, black	2	F604-175
Jack, red	2	F604-176
Knob	1	G604-137
Panel, front	1	R604-128
Printed circuit board	1	T604-126
Socket, pilot lamp	1	K604-444
Sub-plate	1	R604-129

HARDWARE

Lockwasher	1	Package of
Screw, flat-head	4	Hardware
Screw, round-head	10	F604-177
Spacer	2	

WIRE AND SOLDER

Bare wire, 4"	1	Package of
Hook-up wire		Wire
Black, 6"	1	W604-217
Red, 8½"	1	
Yellow, 7"	1	
Green, 8½"	1	
Blue, 6½"	1	
Test leads		
Bananna plug to alligator clip	2 pair	W604-218
Bananna plug to test probe	1 pair	W604-219
Solder, 40"	1	W500-100

ALLIED RADIO CORPORATION
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Chicago, Illinois 60680

Manufactured in Japan
to Allied's Specifications

Kit Stock No.: 22-3902
Manual Stock No.: 22-4179
Production No.: 006-003

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